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The Use of Peer Assisted Learning Activities (P.A.L.A) as a Learning Tool For Elevating Numeracy Proficieny of Students-At-Risk Learners in General Mathematics

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Abstract

Secondary learners frequently encounter difficulties with foundational numerical concepts in General Mathematics, resulting in low proficiency and test anxiety. Peer-Assisted Learning Activities (P.A.L.A) provide structured collaborative scaffolding to address these learning challenges. This study evaluated the impact of P.A.L.A in elevating the numeracy proficiency of Grade 11 learners in General Mathematics (Business Mathematics: Interest and Annuity). A mixed-methods design combining a quasi-experimental pretest-posttest model with phenomenological qualitative inquiry was employed. Thirty Grade 11 ABM students (15 mentors and 15 mentees) at Mandaluyong High School participated via purposive sampling. The study found that at-risk students faced significant challenges in General Mathematics before peer assisted learning activities (P.A.L.A), including problem-solving, writing explanations, applying Math to real-life, and managing exam stress. In Post-P.A.L.A, there was notable improvement in written outputs, performance tasks, and assessments. Initially, 80% were low proficient and 20% not proficient, but after the conduct of P.A.L.A, 87% were nearly proficient and 13% proficient. Pretest scores averaged 9.80, improving to 17.27 in posttest scores. Using the Wilcoxon signed ranked test, the result showed a significant difference between pretest and posttest with p-value of 0.001. Peer-assisted learning activities significantly enhanced numeracy proficiency, engagement, class participation, attitudes toward Mathematics, and teacher facilitation. Despite improvements, additional support is needed for higher proficiency levels. The study recommends implementing P.A.L.A to create a supportive environment, enhance understanding and confidence, develop social skills, improve learning attitudes, and promote collaboration, with parental engagement and introduction to Junior High School to boost numeracy and Mathematics proficiency.

Keywords: *student-at risk. peer-assisted learning, mentor-mentee, numeracy proficiency, General Mathematics*

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Introduction

Prior to the pandemic, teaching Mathematics is a constantly challenging issue. Some of these issues were lower rates of arithmetic skill, less focus on problem-solving skills and critical thinking skills, and putting on Math skills in daily life. There is also a lack of support for students-at-risk of failing. Students who encounter problems understanding basic concepts in Mathematics may find it difficult to make progress for more difficult Mathematical concepts. They experience frustration and are less motivated when given Math assignments or tests and it can affect their understanding of the subject matter and performance as well. Assessments in Mathematics is essential because it simply serves as a diagnostic tool to determine the specific areas that the students may have difficulty with. Through assessment, it allows the teacher to make an intervention or remediation program that provides support to address the learning gaps in Mathematics.

According to the latest PISA results 2022, Philippines placed 6th lowest in reading and Mathematics. In Mathematics, Science, and Reading, the percentage of learners who scored below a baseline level of proficiency did not change greatly from 2018. Nearly all Filipino students obtained Level 5 or 6 on the PISA Mathematics exam, which indicates that they were not among the countries' top Math achievers. The PISA assessment revealed a concerning trend of low-performing students in Mathematics, emphasizing the need for targeted interventions. Learning gap in Mathematics indicates the gap in understanding and skills in Mathematics that are possible among students because of many factors, particularly differences in teaching methods, educational resources, individual learning decisions, and socio-economic backgrounds.

Several studies revealed that students' negative attitudes, anxiety, and lack of confidence in Mathematics affect their academic performance. Mangarin and Gonzalo (2024) found that students in the Philippines exhibit a moderate level of negative attitudes towards Mathematics, showing moderate negative emotions during assessments and exams. Mutia (2025) recommended that students must take initiative to seek assistance from teachers, peers, or family members and conquer Math anxiety by believing in their ability to improve through sustained effort and deliberate practice. Masinading and Gaylo (2022) also found that when learners were taught using differentiated scaffolding strategies, their academic performance significantly increased.

Peer-Assisted Learning (P.A.L) can be used as an educational approach that utilizes the collaborative potential of students to enhance learning outcomes. In this method, students work together in pairs or small groups, with one serving as the "peer tutor" and the other as the "learner." Peer-assisted learning not only reinforces the material being taught but also fosters a deeper understanding of the subject matter through the act of teaching it to someone else. According to Arthur et al. (2022), the effect of peer-assisted Mathematics learning on performance in Mathematics was fully mediated by students' learning interest in Mathematics. Fungamwango (2023) also emphasized that P.A.L positively influenced learners' active engagement, motivation, and self-concept.

The study is anchored on Vygotsky's socio-cultural theory, particularly the Zone of Proximal Development (ZPD), which emphasizes the role of social interaction and guidance in learning. Vygotsky believed that children learn through guided participation with more

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knowledgeable others like teachers or peers. The study is also supported by Bandura's Social Learning Theory, which highlights coaching, connecting, and collaborating as essential in developing knowledge, critical thinking, and problem-solving skills. Peer mentorship within this framework can help students-at-risk improve numeracy proficiency by providing guidance, inspiration, and support from more proficient peers.

The study aims to determine the effect of the use of Peer Assisted Learning Activities (P.A.L.A) as a learning tool for elevating the numeracy proficiency of student-at-risk learners in General Mathematics. Specifically, it seeks to identify the challenges affecting learners' performance before and after the conduct of P.A.L.A, determine the numeracy proficiency of learners before and after the intervention, and examine the perceived effects of P.A.L.A on engagement, class participation, attitude towards Mathematics, and teacher facilitation skills. The study hypothesizes that the numeracy proficiency scores of student-at-risk learners significantly increase after the use of Peer-Assisted Learning Activities.

Materials and Methods

Research Design

The study utilized a mixed-method research design to provide a holistic understanding of the efficacy of Peer-Assisted Learning Activities (P.A.L.A.) as a learning tool on the numeracy proficiency of student-at-risk learners. The quantitative approach used a quasi-experimental pretest–posttest design to compare numeracy proficiency scores before and after the implementation of P.A.L.A. Survey responses were also gathered to determine the learners' experiences, perceptions, and academic progress. The qualitative approach integrated phenomenological methods (Alhazmi, A.A., and Kaufman, A., 2022) through classroom observations and participants' experiences to describe how students interacted with peers, responded to collaborative activities, and experienced challenges and support during the intervention. The mixed-method design ensured methodological triangulation, strengthening the credibility of the findings through numerical data and descriptive accounts.

Participants

The population of the study consisted of 30 Grade 11 ABM learners enrolled in General Mathematics at Mandaluyong High School. Purposive sampling was used in selecting 15 mentors and 15 mentees based on Region III–Eastern Visayas Regional Order No. 039, s. 2021 entitled "Policy Guidelines in the Implementation of Learning Achievements via Mentoring Program." Mentors were students with outstanding academic performance, good social skills, patience, and willingness to support others, while mentees were students-at-risk who needed additional support and voluntarily joined the mentoring sessions. Most participants belonged to the 17–18 age group, and the number of male and female participants was equally distributed. Students with grades 90–100 served as mentors, while students with grades 70–74 served as mentees.

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Instruments

The research instruments included a 30-item pretest and posttest, five activity sheets, survey questionnaires, classroom observations, and open-ended questions. The instruments were designed to evaluate learners' understanding and proficiency in General Mathematics, particularly Business Mathematics. The survey questionnaires gathered information about learners' challenges before and after the implementation of P.A.L.A, as well as the perceived effects of the intervention on engagement, participation, attitude toward Mathematics, and facilitation skills of the teacher. A Likert Scale was used to measure agreement levels. The instruments were validated by experts and pilot tested with 10 respondents. Reliability testing using Cronbach's alpha showed good and excellent levels of reliability, with values ranging from 0.87 to 0.97.

Procedure

Before the conduct of P.A.L.A, the research instruments were validated and approved by experts and the adviser. Permission to conduct the study was secured from the school administration, and consent forms were provided to parents and guardians. Participants were selected based on the established criteria for mentors and mentees. A 30-item pretest was administered to assess the baseline knowledge of the students. During the implementation of P.A.L.A, targeted lessons and worksheets focusing on least mastered skills were used. Mentors and mentees engaged in regular one-on-one peer mentoring sessions, where mentors guided discussions and supported problem-solving activities. After the intervention, a posttest and survey questionnaires were administered to evaluate improvements in numeracy proficiency and gather participants' feedback regarding the intervention.

Data Analysis

The study used both quantitative and qualitative data analysis. Quantitative data from pretest and posttest scores and survey responses were analyzed using frequency, percentage, weighted mean, and Wilcoxon Signed-Rank Test to determine the significant difference between pretest and posttest results. Qualitative data from classroom observations, feedback, and open-ended responses were analyzed using thematic and narrative analysis. Triangulation was used to compare data from multiple sources to strengthen the validity and reliability of the findings. Numeracy proficiency levels were interpreted using the DepEd proficiency scale ranging from "Not Proficient" to "Highly Proficient."

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RESULTS AND DISCUSSION

The challenges that affect the learners' performance in General Mathematics before the conduct of peer-assisted learning activities (P.A.L.A) in written outputs, performance tasks, and assessments or examinations.

Table 1.
Challenges that Affect the Learner's Statements Performance in General Mathematics Before the Conduct of P.A.L.A

Statements	Overall weighted mean	Standard deviation	Verbal Interpretation
Written Outputs	2.97	0.471	Agree
Performance Tasks	2.84	0.497	Agree
Assessment or Examination	3.01	0.437	Agree

Before the conduct of P.A.L.A, the results show that participants agreed that they experienced challenges in written outputs, performance tasks, and assessments, as shown by the weighted means of 2.97, 2.84, and 3.01, respectively. The findings reveal that participants struggled with independent problem-solving and expressing their ideas, often feeling nervous and overwhelmed, particularly during exams and presentations. These challenges affected their confidence and overall performance, emphasizing the need for guided support and collaborative learning such as P.A.L.A as an intervention.

The challenges that affect the learners' performance in General Mathematics after the conduct of peer-assisted learning activities (P.A.L.A) in written outputs, performance tasks, and assessments or examinations.

Table 2.
Challenges that Affect the Learner's Statements Performance in General Mathematics After the Conduct of P.A.L.A

Statements	Overall weighted mean	Standard deviation	Verbal Interpretation
Written Outputs	3.17	0.550	Agree
Performance Tasks	3.15	0.510	Agree
Assessment or Examination	3.15	0.403	Agree

After the conduct of P.A.L.A, the results show that participants strongly agreed that they experienced challenges in written outputs, performance tasks, and assessments were reduced, as shown in weighted means of 3.17, 3.15, and 3.15, respectively. The findings reveal that P.A.L.A

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helped improve participants' understanding, confidence, and participation through peer discussions and collaboration. While participants initially faced difficulties, continuous support from peers and mentors led to gradual improvement in accuracy and independence. However, some participants still experienced lower confidence when working individually, particularly in written tests and unfamiliar tasks, indicating the need for development of independent problem-solving skills.

The numeracy proficiency of student-at risk learners before and after the implementation of peer-assisted learning activities (P.A.L.A).

Table 3.
Frequency and Percentage Distribution of Students At-Risk' Numeracy Proficiency Before and After the Implementation of P.A.L.A

Numeracy Proficiency	Before		After	
	Frequency	Percentage	Frequency	Percentage
Highly proficient (90% - 100%)	0	0.00	0	0.00
Proficient (75% - 89%)	0	0.00	2	13.00
Nearly Proficient (50% - 74%)	0	0.00	13	87.00
Low proficient (25% - 49%)	12	80.00	0	0.00
Not proficient (0% - 24%)	3	20.00	0	0.00
Total	15	100.00	15	100.00

Before the intervention, the results show that there were twelve (12) participants or 80% are low proficient and three (3) participants or 20% were not proficient in numeracy. It indicates that learners were still struggling with basic numeracy skills in General Mathematics. In terms of specific competencies in simple interest, compound interest, and annuities, most participants were at the non-mastery to low-mastery level. While a few showed near mastery in identifying concepts, the majority had difficulty solving problems and performing computations. The findings reveal limited understanding and low confidence in applying Mathematical formulas prior to the implementation of P.A.L.A. On the other hand, none of the at-risk students achieved a higher level of proficiency. There is a significant improvement in the numeracy proficiency of at-risk students after the intervention. Specifically, thirteen (13) participants or 87% of the participants were nearly proficient and two (2) participants or 13% were proficient. None of the participants were highly proficient, low proficient, or not proficient. It indicates that P.A.L.A helped prevent participants from performing at the lowest levels. In addition, posttest results revealed improvement in learning competencies, with many participants progressing from non-mastery and low-mastery levels to developing and approaching mastery. Improvements were evident in understanding interest concepts, performing computations, and solving related problems. However, some participants still required practice to achieved full mastery, particularly in complex application such as annuities. This implies that P.A.L.A as an intervention aim to provide additional guidance, collaboration, and practice opportunities that may help them strengthen their understanding of Mathematical concepts and gradually improve their proficiency levels.

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The significant difference between the pretest and posttest results of at-risk students before and after the intervention.

Table 4.
Computed Values on the Significant Difference Between the Pretest and Posttest Results of At-Risk Students Before and After the Intervention

Test	Mean	Standard deviation	P value	Interpretation	Decision
Pretest	9.80	2.484	0.001	Reject the Ho	Statistically different
Posttest	17.27	3.195			

The results show that the average score in pretest is 9.80 with a standard deviation of 2.484 while the average score in posttest is 17.27 with the standard deviation of 3.195. This indicates that the use of peer-assisted learning activities is helpful in improving Math skills among students who struggle with it. Using the Wilcoxon signed-rank, the computed p-value of 0.001, indicates a significant difference in numeracy proficiency before and after the intervention among P.A.L.A learners.

The perceived effect of the use of P.A.L.A in engagement level of learners, class participation, attitude towards Mathematics and facilitation skills of teacher.

Table 5.
The Perceived Effect of the Use of P.A.L.A to the Students' Performance

Statements	Overall weighted mean	Standard deviation	Verbal Interpretation
Engagement level of learners	3.35	0.457	Strongly agree
Classroom participation	3.35	0.526	Strongly agree
Attitude towards Mathematics	3.23	0.705	Agree
Facilitation skills of teacher	3.60	0.472	Strongly agree

The results show that participants strongly agreed that P.A.L.A improved their engagement level, class participation, and facilitation skills of teacher with weighted means of 3.35, 3.35, 3.60, respectively. While participants agreed that it improved their attitude towards Mathematics with weighted mean of 3.23. The findings reveal that P.A.L.A created a more interactive and supportive learning environment where participants became more motivated, confident, and active in participating. Although some difficulties remained in complex topics, overall findings show that peer-assisted learning, supported by strong teacher facilitation, positively enhanced learners' learning experience in General Mathematics.

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Programs that can be proposed in enhancing numeracy proficiency for the student-at risk learners.

The intervention programs such as "Math-tulungan Tayo!: Peer-Tutoring Program for Grade 11 Students", "MMK: Matuto ng Matematika, Kaibigan!: Stress-free Mathematics Program, and "Strategic Instructional Materials for Business Mathematics in General Mathematics" are designed to utilize peer-assisted learning activities effectively to achieve specific educational goals in numeracy proficiency, academic performance, teaching strategies, and Math interventions.

Conclusion

Based on the findings of the study, herewith are the following conclusions:

1. Before the implementation of P.A.L.A, at-risk students experienced challenges that affected their performance in General Mathematics across written outputs, performance tasks, and assessments or examinations. In terms of written output, they struggled with understanding concepts independently, making it harder for them to complete tasks confidently. For performance tasks, they struggled to organize their ideas and apply the appropriate strategies, which led to hesitation and low confidence in solving Math problems. During assessments or examinations, feelings of anxiety and pressure became more evident, preventing them from performing at their best. Overall, these challenges indicate that at-risk students need more support and guidance in the learning process. This emphasizes the importance of P.A.L.A, which can enhance understanding, build confidence, reduce stress, and promote a more engaging and collaborative learning experience.

2. After the implementation of P.A.L.A, at-risk students showed noticeable improvement in their performance in General Mathematics across written outputs, performance tasks, and assessments or examinations. Working with peers allowed them to feel more supported and encouraged, which helped examinations. Working with peers allowed them to feel more supported and encouraged, which helped them participate more actively. Despite the positive results, some challenges still remain. In terms of written outputs, at-risk students still need more guidance in checking and improving their solutions, indication that their ability to work independently is still developing. For performance tasks, there was clear progress in participation and understanding, but some at-risk students continue to depend on peer support when solving problems. During assessments or examinations, at-risk students appeared more confident and engaged but many still need to strengthen their independent problem-solving skills. Overall, while P.A.L.A created a positive and collaborative learning environment, there is still a need for additional guided practice and strategies that gradually build learners' independence and accuracy in solving Mathematical problems.

3. Before the implementation of P.A.L.A, at-risk students showed low numeracy proficiency indicating struggles in understanding key Mathematical concepts. These results emphasize a strong need for additional support, guided instruction, and collaborative learning opportunities to help them build their skills. After P.A.L.A was implemented, a clear improvement was observed. Many of them progressed from being struggling to becoming nearly proficient and even proficient, which

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shows not only better performance but also increased confidence in business Mathematics. This implies that P.A.L.A provided the support and encouragement they needed to gradually improve. Overall, these reveal that P.A.L.A is an effective approach in helping at-risk students develop their numeracy skills and should be continued and strengthened with other teaching strategies to sustain their progress.

4. There is clear evidence that the at-risk students significantly improve before and after the intervention. At-risk students show significantly greater improvement when engaged in peer-assisted learning activities (P.A.L.A), emphasizing the effectiveness of these activities in elevating numeracy proficiency among students struggling with General Mathematics.

5. It is evident that use of P.A.L.A has a positive perceived effect on students' performance across all aspects. In terms of engagement, P.A.L.A makes learning more interactive and meaningful, leading to increase attentiveness, confidence, and active involvement among participants. In class participation, participants become more willing to contribute, collaborate, and gradually develop independent problem-solving skills within a supportive and inclusive environment. In addition, P.A.L.A also helps improve attitude towards Mathematics. Many participants feel less anxious and more confident because they are supported by their peers, making Math feel less intimidating and more enjoyable. Lastly, the teacher plays an important role by guiding and supporting the learners while allowing peer interaction to take place, creating a classroom environment that is both structured and friendly. Overall, P.A.L.A helps create a more positive and supportive learning experience where students are more engaged, more participative, more confident in General Mathematics, and better guided through effective teacher facilitation.

6. The proposed intervention programs, which aims to enhance the numeracy proficiency, promotes a supportive learning environment and inclusive group projects, and facilitate guided learning with peers, are strategically designed for the effectiveness of peer-assisted learning activities in achieving targeted educational objectives related to numeracy proficiency, academic performance, teaching strategies, and Mathematics interventions.

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